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Citation for final published version:

Ikram, Salima, Nicholson, Paul ORCID: <https://orcid.org/0000-0001-5472-6788>, Bertini, Louise and Hurley, Delyth 2013. Killing man's best friend? Archaeological Review from Cambridge 28 (2) , pp. 48-66. file

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Killing Man's Best Friend?

Salima Ikram, Paul Nicholson, Louise Bertini, Delyth Hurley

“What happens when a house catches fire is most extraordinary: nobody takes the least trouble to put it out, for it is only the cats that matter...All the inmates of a house where a cat has died a natural death shave their eyebrows, and when a dog dies they shave their whole body including the head. Cats which have died are taken to Bubastis where they are embalmed and buried in sacred receptacles; dogs are buried also in sacred burial places, in the towns where they belong.”

(Herodotus *Histories* Book II: 66-67)

Herodotus's account of the high regard in which the ancient Egyptians held cats and dogs has shaped the modern understanding of how these creatures were regarded-viewed in Egyptian society. Although dogs feature prominently in Egyptian two- and three-dimensional representations, texts, and burials, (see Houlihan 1996; Rice 2006), evidence from the necropoleis of Saqqara, Bubastis, and Stabel Antar has shown that cats were frequently strangled before burial in sacred precincts, such as the Bubastieion or its equivalent (Zivie and Lichtenberg 2005; Armitage and Clutton-Brock 1980, 1981; Ikram and Iskander 2002), while new work by the authors¹ suggests that the lives of those dogs interred in the Catacombs of Anubis (the Anubieion) might have been very short indeed. That “a dog is man's best friend” may be as true for ancient Egypt as it is today but the nature of that friendship must be viewed very differently, depending on context.

The Dog Catacombs at Saqqara, a subterranean series of galleries covering over 4946.84 m² (fig. 1), contained the mummified remains primarily of dogs, sacred to the canine deity Anubis. Anubis was a god of embalming who was also responsible for taking the deceased from this world to the next and consequently was a patron of travellers (DuQuesne *et al.* 2007). These animals probably functioned as votive offerings dedicated to Anubis (Ikram 2005; Ikram, in press), and, like their feline and avian counterparts (Ikram 2005), had the ability to intercede with the god on behalf of those who had provided for them a burial fit for a god.

Fig. 1 Plan of the Galleries of the Anubeion showing those galleries in which dog mummies remain. (Plan by S. Mills and S. Williams).

A few of these animals probably lived in the Anubieion temple at Saqqara and were regarded as living representatives of the god Anubis. Their mummies might be categorized as those of ‘Sacred Animals’ (Ikram 2005) who were worshipped during their lifetimes as manifestations of the god, and then mummified and buried with great pomp after their death. These creatures may be those given especially prominent burials in niches in the Catacomb, sometimes with wooden coffins provided for them. The great majority of the animals were used as votive offerings, and they were given only cursory mummification (desiccation with natron, followed by anointment with some oils and resins, and finally wrapping in linen bandages) before being stacked in relatively orderly heaps within the catacomb.

¹ The *Catacombs of Anubis* project is a Cardiff University project in association with the Egypt Exploration Society and is directed by Nicholson. Funding for the project has come from the National Geographic Society, Cardiff University and the Thames Valley Ancient Egypt Society as well as Andante Travels.

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During the course of the initial EDM survey and exploration of the individual tunnels within the monument the team noted that there were two forms of burials: what appear to be single animals in niches located along the lower levels of the galleries, and large numbers of mummies and bones piled in the galleries proper. As most animal catacombs generally contain two types of burial, sacred and votive (Ikram 2002; 2001; 2005), the working hypothesis has been that the niched dogs were Sacred, while the remainder were Votives. This paper will focus on the votive mummies.

The Site

The Saqqara which tourists see today, a quiet and lonely place on the desert not far from modern Cairo, is a world apart from that seen by the Egyptians of the Late Period (747-332 BC) and those who followed in the Ptolemaic and Roman eras. Burials had been made at Saqqara since at least the First Dynasty (3100-2890 BC) and it became the site of the earliest pyramid during the reign of Djoser (2667-2648 BC), with tombs being added through every period of Egyptian history. Not only were Kings and commoners buried at the site, but also sacred animals (for a summary see Nicholson 2005). Whilst the Apis bull is the most famous of these, he was joined in the Late Period by a host of other animals—cows, ibises, falcons, baboons, cats and dogs (to name only those whose burial places have actually been located). All of these creatures had a priesthood to support their cult and the cults required numbers of ancillary workers to support them (see Ray 1976; Smith 1974).

As a result, there were at Saqqara and in its environs potters who produced jars for the burial of the sacred birds, embalmers who probably specialised in the embalming of particular species, priests whose duties included feeding the animals, and others whose role it was to speak on behalf of the animals. Many, if not all, of the sacred animals had an oracular role and priests relayed their oracles to pilgrims (see for example Smith, Davies and Frazer 2006: 26). Moreover, at a time when Egypt was increasingly part of the Mediterranean world and was from time to time subject to foreign rule, the animal cults perhaps represented the epitome of what it was to be traditionally Egyptian. As a result of their 'patriotic' role and their ability to intercede with the gods, the sacred animals became enormously important from the Late Period into early Roman times.

Accordingly, the visitor to Saqqara would find the site cluttered with temples and shrines, busy with interpreters of dreams and sellers of votive trinkets such as bronze *situlae* and figures of the gods (see for example Smith 1974: 64ff; Ray 2002: 130ff). Amongst these people were the priests who would have arranged for a pilgrim to have an animal mummified and given a fitting burial in one of the catacombs. The pilgrim might have done this in fulfilment of a vow, in gratitude for a good deed attributed to a particular god, as a 'bribe' in the hope of receiving favour or simply from a sense of personal piety. Whatever the case, the result was the same—a mummy required a deceased animal.²

The Dog Catacombs were situated at the north-east side of the Saqqara Plateau in conjunction with the Anubeion or Temple to Anubis and contained massive deposits of canine mummies dedicated to Anubis. The area was first published by J. de Morgan (1897) on a map, with no text providing details about the discovery and recording of these catacombs, nor documentation of any analysis of the mass of animal mummies that it contained.

² Or at least part of one. It is known that some falcons were often represented by only a part of a bird, perhaps because of the difficulty of breeding/procuring these creatures.

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The question of how these canines were obtained has been one of the ~~questions~~ ~~issues~~ investigated by the *Catacombs of Anubis* project. Although the writers cannot yet say for exactly how long the Dog Catacombs ~~were~~ ~~as~~ in use (radiocarbon dates are ~~being~~ ~~awaited~~ ~~forthcoming~~), it has been possible to estimate that it may originally have contained as many as 8,000,000 animals. Even if the site was in use from the fourth century BC and continued for four centuries, more than 50 animals would have been required daily to reach this figure. Such numbers could not have been bred and housed in the nearby temple of Anubis and one must consider the possibility that the animals were farmed.

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Methodology for Studying the Canine Remains

The deposit of mummified dogs is very dense and for the most part the wrappings have disintegrated, making it difficult to sample the individual mummies that had been placed in the galleries (fig. 2a and b). A total of 49 galleries were identified and planned by the project. Of these, 26 contained animal remains, the others having been emptied at some earlier date (awaiting results of C-14 samples), presumably when the mummies were used as *sebbakh* (fertilizer) or fuel. Of these galleries only 21 were sampled due to safety restrictions.

Fig. 2a Looking along the axial aisle of the Anubeion. The burials were made in the shorter tunnels opening to left and right of the axial. (Photo: P.T. Nicholson).

Fig. 2b. Gallery 11 showing the masses of decayed dog mummies. (Photo: P.T. Nicholson).

A 15 litre sample of mummified animals was taken from each gallery containing remains. Initial samples were taken by scooping the decayed mummies into the container. This has the advantage of confining the sampling to a very specific area and taking what is essentially a sediment column. The disadvantage of the technique is that a great deal of mummy powder (decayed wrappings, fur, and flesh) is collected within the 15 litres and some bones may be broken in the sampling process. A more effective method was developed and used: the hand-collection of bones and partial mummies (where they exist) from a defined area sufficient to make up the sample. This may be regarded as subjective, but since the bones are frequently from the same individual and in partial articulation this maximises the information available to the analyst as well as minimising the amount of debris collected and, most importantly, caused minimal damage to the bones.

The ~~location~~ ~~position~~ of the deposits varied—the sample areas were not chosen totally at random but, where possible, by selecting undisturbed areas and taking the samples from these. Where more solid and complete mummified animals were available, these were also collected for study in a data set separate from the bulk sample. The complete mummies were kept for radiographic and macroscopic examination, and are not part of the data set under discussion here; this is also the case for the mummies found in the niches.

The bones were sorted by anatomical element and then the following information was recorded: taxon, anatomical element, age, sex, pathology, weathering, and dimensions. Due to time constraints ribs and fragments measuring less than 1cm were not recorded. The mature bones were measured and the immature ones counted and grouped according to size (e.g., over 3cm, over 5cm, and so forth, depending on the anatomical element). Due to time constraints the ulnae, vertebrae, ribs, and most of the pelvises of all the animals, and radii of the immature animals were not measured.

The identifications were made in the field using a comparative collection of skeletons and publications. Ageing is based on Silver (1963) and Schmid (1972), and the measurements follow von den Driesch (1976); an attempt at sexing using humeri, based on the work of Ruscillo (2006) was made but not followed, as the team were not sufficiently confident about its efficacy, and thus ~~relied on~~ baculi and skull morphology were relied upon for sexing (Crockford 2009).

The Data Set and its Results:

The Number of Identified Specimens (NISP) from the catacombs totalled 6034 bones. All elements of the skeleton were present, including hyoids of immature animals, all in different degrees of preservation. Although the vast majority of the identified animals were dogs (*Canis lupus familiaris*), jackals (*Canis aureus*) and foxes (*Vulpes* sp.), all of which the ancient Egyptians taxonomically identified with dogs (Charron 2001, 2003), other animals were also interred in the catacombs. These included mongoose (*Herpestes ichneumon*), cat (*Felis catus*), and wild or jungle cat (*Felis chaus nilotica*) (see fig. 1),³ in addition to cattle, raptor and equid bones.⁴ There are various explanations for the inclusion of other animals in these catacombs (Kessler 1986), including their relative mythological relationships to Anubis (DuQuesne *et al.* 2007), ~~but~~ However, the mythological and religious beliefs surrounding Anubis are beyond the scope of the present paper, which will only focus on the dog remains from the site. Unfortunately, it is difficult if not impossible to identify different dog breeds, but one can potentially differentiate them based on size and proportions, especially of skulls. The Dog Catacombs yielded a significant population of at least two and possibly three breeds of dog, the evidence for which will be presented elsewhere in the final publication of the site (Nicholson, forthcoming).

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The Minimum Number of Individuals (MNI)

The Minimum Number of Individuals (MNI) per 15 litre sample of dog mummy varied as some contained a much higher number of immature animals than others; thus, for example, the 15 litre sample from Gallery 9—an extreme example—yielded a total MNI of 52 dogs, 5 adults (over one year old) and 47 immature ones, while the Gallery 36 sample contained 11 adult animals and 4 immature ones. The total dog remains from the 21 galleries sampled yielded a MNI of 485 dogs (Table 1). This leads us to extrapolate a deposit of approximately eight million dogs in the entire catacomb (above).

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Table 1 The Number of Identified Specimens (NISP) from the 15 litre samples and the Minimum Number of Individuals (MNI) estimated from these

Age Ranges

A significantly large age distribution was noted throughout the galleries. A cursory visual inspection of the galleries indicated that no gallery was specifically filled with either mature

³ Differentiation was based on measurements and comparison with the images and number from Osborn and Helmy (1980).

⁴ There is still some discussion as to whether these bones were part of the original deposit or if their presence might have some other explanation.

or immature dogs. Rather, each one contained mummies of neonates through to elderly animals, although, for the most part (about 75% of the total sample) there was a preponderance of immature animals (fig. 3 and 4). Clearly such a volume of puppies did not meet their end naturally, and must have been killed, as has been found in the case of kitten mummies recovered from their mass burials at Saqqara and elsewhere (Zivie and Lichtenberg 2005; Armitage and Clutton-Brock 1980, 1981).

Fig. 3 Age distribution of all dogs, based on MNI

Fig. 4 Age (in months) distribution of dogs from each gallery, based on MNI

Sex

Sex was determined by the presence or absence of baculi as well as skull morphology (Crockford 2009: 49) wherever possible (Table 2). This does not necessarily mean that all those animals classed as non-males were in fact female, since baculi and skulls are not always sufficiently well preserved, particularly among young animals.⁵ This of course skews one's interpretation, but it is interesting that the number of clearly identified males to females was 37 to 4. Offering more males than females makes sense if one wished to keep the breeders active, and dispose of the more aggressive, more difficult to manage, and less useful (for breeding) male animals.

Table 2 Identified males versus females; the '0' indicates that ~~neither~~ sufficient evidence ~~neither~~ from skulls nor baculi was found to attribute sex with any confidence.

Pathology

A striking aspect of the assemblage was the evidence for disease and trauma: 266 canid bones (4.8%) showed evidence of pathology (Baker and Brothwell 1980 served as a guide for disease identification).⁶

Table 3 Pathology on all bones of immature and mature dogs

Table 4 Pathology only on skulls and mandibles of immature and mature dogs

The most common pathology took the form of arthrosis (due to osteophytes), most commonly on vertebrae, although other bones were also affected (distal tibiae, humeri, etc), although not as frequently as were the vertebrae; at least 40 centrum bodies were thus afflicted, about 15% of the sample. As the deformed vertebrae indicate, ~~s~~Spondylosis deformans is commonly found in canids (Rothschild *et al.* 2001; Morgan *et al.* 1967); ~~although~~ Although advanced stages of this ~~spondylosis~~ are uncomfortable for dogs, they can still function (Harris

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⁵ The D. Ruscillo (2006) humerus test was not used as the analysts had limited success with it when it was carried out on our comparative specimens whose sex was known.

⁶ 15 bones of cats, jackals, and foxes also manifested pathology, but are not included here.

1977). There were also three examples of complete vertebral fusion in the older animals, which would have made it difficult for the animals to move without pain.

Causes of spondylosis deformans are variable. Kramer *et al.* (2002) report that many factors can be linked to this condition, including age, body mass, trauma, type and level of activity, and sex, with males being more susceptible. ~~maleness~~masculinity. Most of the cases are attributed to mechanically induced defects such as excessive flexion or hyperextension of the spine or a blunt crushing blow to the back (Duckler 1997). It is possible that the dogs (males?) were kept in constrained spaces where their backs were flexed, or that they ~~might have~~ may have suffered blows to the back; perhaps this was a method used to control or separate aggressive animals.

There were also a handful of cases of probable bone fractures that had completely misaligned after healing—clearly no splinting took place. While these might have been due to abusive management of the animals, it could as easily be a result of fights between dogs, or injuries taking place naturally. There was evidence of trauma to the cranium in two adult individuals which took the form of a circular depression 15mm in diameter on the frontal bone^s, and may have occurred from being hit with a blunt object, probably a stick (fig. 5); such head-blows are often associated with human actions related to control or rebuke of dogs (Makowiecki and Daugnora^s; 2004). However, since remodelling of the bone is evident this was not the cause of death and the animal would have lived on. A similar indentation was found on a juvenile animal, no more than two months of age, who also survived this event. In another canine deposit at Saqqara's Teti Cemetery, where 400 skulls were studied, 24 showed evidence for similar blunt force trauma^s; 6%, compared with our 0.75%. This suggests that the management of the Anubeion dogs was far kinder than that of other animals who played a similar role at Saqqara (Hartley *et al.* 2011), or at least, heads were not the focus of disciplinary action, although it is possible that backs were (see [above](#)).

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There were a few cases of bone remodelling possibly following a bacterial infection as a result of an open wound, and at least eight sets of bones ([seven](#) non vertebral; one set of vertebra) were fused together, following infection. Other pathologies noted included alveolar resorption and (antemortem) tooth loss (15 examples, 5.6% of the total sample). All of these pathologies can be manifested in animals living in the wild, but can also be attributed to bad management/care by humans, in terms of diet, trauma due to crowded living conditions or disciplinary action, and the lack of veterinary care (Lukacs 2006), and are well-documented in Egyptian canid assemblages (Churcher 1993). Additionally, tooth loss might be associated with a high number of pregnancies with insufficient dietary supplements being provided for the dam (Lukacs and Largaespada 2006), and one might posit that these are some of the remains of the females used for breeding.

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On the whole, the number of pathologies engendered by disease and/or trauma were quite low, totalling 4.8% of the entire sample; however, one should bear in mind that for many individuals in the sample, death would have swiftly followed birth, leaving little time for pathologies to develop on the bones. Unfortunately, there were no clear indications on the bones, or ~~visible in~~noted in the complete mummies that were x-rayed, to indicate cause of death. Obviously, drowning, poisoning or separation from the mother at too early an age (starvation) would leave no evidence on the bones.

Conclusions

The estimated eight million dog burials in the catacombs of the Anubeion indicate that the dogs were mostly bred in farms, probably in and around ancient Memphis. The high number of neonates strongly suggests that this was an almost industrial production with puppies being killed, perhaps by drowning or exposure ~~at~~ immediately after birth before being given a cursory mummification.⁷ What is not clear is whether the dedicatees of mummies actually knew the scale of these operations or that they were paying for such young animals. It may well be that they did not. We know from the *Archive of Hor* (Ray 1976) that the ibises were buried at a ceremony once each year having been temporarily stored until the ceremony was due. If the same were true of the dogs then pilgrims may not have seen the mummy they purchased months ahead of the ceremony itself. Whilst it could be speculated that pilgrims arrived at Saqqara having already selected and purchased an animal from the puppy farms, ~~this seems unlikely~~ there is no evidence to support this hypothesis. Priests were probably required to oversee the embalming to ensure that the process was fit for a god and it therefore seems more likely that they were the point of contact with the pilgrim who trusted them to act on their behalf. Certainly the *Archive of Hor* (Ray 1976) and other evidence from animal cult centres would support this idea (Ikram 2005). If this transaction took place at the Anubieion temple, where large well-fed dogs were kept, pilgrims probably formed the impression that it was dogs of this sort whose burials were being paid for. None but the priests and their assistants would have seen inside the great catacomb with its stacks of mummies. None but they would have fully appreciated the way in which “man’s best friend” was being bred and maintained, or the scale on which it was ~~being~~ killed.

All that said, this process cannot be viewed through ~~twenty-first~~ century eyes. It is certain that those dedicating animals would have done so with the best of motives and would not have viewed this as a cruel act. These were individuals who were doing a good deed for a representative of the deity, providing the animal with a fitting burial in the hope that it speak well of them with the god. Any suggestion of cruelty or impropriety would negate the whole interchange. Seen from this perspective the sacred animals remain objects of veneration, just as Herodotus states.

Acknowledgements

The authors are grateful to the permanent committee of the *Supreme Council for Antiquities/Ministry of State for Antiquities* for permitting our work at Saqqara and to their representatives at Saqqara for their help in the work. The project has been funded by the *National Geographic Society* (grants #8797-10 and GEFNE 4-11), Cardiff University, the *Thames Valley Ancient Egypt Society* and *Andante Travels* to all of whom we are grateful.

The authors are grateful to the team members on the project: Tessa Baber, Erin Earl, John Harrison, Steve Mills, Hendrikje Nouwens, Ying Qin, Mari Rygh, and Scott Williams, ~~particularly and for this paper, particularly~~ the members of the bone team, Sabine Harding and Ariel Singer. Also, to Stephanie Vann for her input on the pathologies.

References and Bibliography

⁷ We have no evidence for poisoning or strangulation, although both options are possible.

Armitage, P.L., and J. Clutton-Brock. 1980. Egyptian Mummified Cats held by the British Museum. *MASCA, Research Papers in Science and Archaeology* 1: 185–188.

Armitage, P.L., and J. Clutton-Brock. 1981. 'A Radiological and Histological Investigation into the Mummification of Cats from Ancient Egypt', *Journal of Archaeological Science* 8: 185-96.

Baker, J. and D. Brothwell. 1980. *Animal Disease in Archaeology*. London: Academic Press.

Charron, A. 2003. Taxonomie des espèces animales dans l'Egpte gréco-romaine. *Bulletin de l'Institut Française de l'Archéologie Orientale* 156: 7-19.

Charron, A. 2001. Les Canidés Sacrés dans l'Égypte de la Basse Époque. *Egypte, Afrique, et Orient* 23: 7-22.

Churcher, C.S. 1993. Dogs from Ein Tirghi Cemetery, Balat Dakhleh Oasis, Western desert of Egypt. In Clason, A., Payne, S. and Uerpmann, H-P. (eds), *Skeletons in her Closet: Festschrift for Juliet Clutton-Brock* (Oxbow Books Monograph 34) Oxford: Oxbow Books, 39-60.

Crockford, S. J. 2009. *A Practical Guide to in situ Dog Remains for the Field Archaeologist*. Victoria, BC, Canada: Pacific Identification Inc.

Daressy, G. and Gaillard, C. 1905. *La Faune Momifiée de l'Antique Égypte*. Cairo: Institut Français de l'Archéologie Orientale.

Dodson, A. 2005. Bull cults. In Ikram, S. (ed.) *Divine Creatures*. Cairo: American University in Cairo Press, 72-105.

Duckler, G.L (1997) A case of spondylosis deformans in the defleshed skeleton of a wild coyote and its significance to osteopathologic interpretation, *J Wildlife Dis*, 33: 211-219.

DuQuesne, T, El-Sadeek, W, Razek, S.A, Hawass, Z.A, and Fatah, M.A. 2007. *Anubis, Upwawet, and other deities: personal worship and official religion in Ancient Egypt*, The Egyptian Museum Cairo, Printed by the Supreme Council of Antiquities Press.

von den Driesch, A. 1976. *A Guide to the Measurement of Animal Bones from Archaeological Sites*. Cambridge, MA: Peabody Museum/Harvard University.

Harris, S. (1977). Spinal arthritis (spondylosis deformans) in the red fox, (*Vulpes vulpes*), with some methodology of relevance to zooarchaeology, *Journal of Archaeological Science* 4:183–95.

Hartley, M., A. Buck, S. Binder. 2011. Canine Interments in the Teti Cemetery North at Saqqara during the Graeco-Roman Period', F. Coppens, J. Krejci (eds.), *Abusir and Saqqara in the Year 2010*. Czech Institute of Egyptology, Prague, 17-29.

Herodotus *The Histories*. (Trans. de Sélincourt 1972). Harmondsworth: Penguin.

Ikram, S. (Ed.) 2005. *Divine Creatures: Animal Mummies in Ancient Egypt*. Cairo: American University in Cairo Press.

Ikram, S. In press. Man's Best Friend for Eternity: Dog and Human Burials in Ancient Egypt. In Arbogast, R. and S. Lepetz (eds), *Dogs and Humans*.

Ikram, S. and N. Iskander. 2002. *Catalogue Général of the Egyptian Museum: Non-Human Remains*. Cairo: Supreme Council of Antiquities.

Kramer, P.A, Newell-Morris, L.L, and Simkin, P.A. 2002. Spinal degenerative disk disease (DDD) in female macaque monkeys: epidemiology and comparison with women, *Journal of Orthopaedic Research* 20: 399-408.

Lortet, C. L. and Gaillard, C. 1903-09. *La faune momifiée de l'ancienne Egypte*. Lyon: Archives du Muséum Histoire Naturelle de Lyon VIII: 2, IX: 2, X: 2.

Lukacs, J.R (2006) Dental trauma and antemortem tooth loss in prehistoric Canary Islanders: prevalence and contributing factors, *International Journal of Osteoarchaeology* 17: 157-173.

Lukacs, L.R, Largaespada, L.L (2006) Explaining sex differences in dental caries prevalence: saliva, hormones, and "life-history" etiologies, *American Journal of Human Biology*, 18: 540-555.

Makowiecki, D. and Daugnora, L. 2004. Preliminary Study of Pathological Dog Skulls from Roman Influence Burials in the Polish Lowlands. *Abstracts of the International Conference of the Animal Palaeopathology Working Group (APWG) of the International Council for Archaeozoology (ICAZ), 23-24 September 2004, Nitra, Slovakia*: 16-17.

De Morgan, J. 1897. *Carte de la Nécropole de la Memphite: Dahchour, Sakkarah, Abou-Sir*. Cairo: Institut Français de l'Archéologie Orientale.

Morgan, J. P, Ljunggren, G, and Read, R. 1967. Spondylosis deformans (vertebral osteophytosis) in the dog, *Journal of Small Animal Practice* 8: 57-66.

Nicholson, P.T. 2005. The Sacred Animal Necropolis at North Saqqara: the cults and their catacombs. In Ikram, S. (ed.) *Divine Creatures*. Cairo: American University in Cairo Press, 44-71.

Nicholson, P.T. forthcoming. *The Catacombs of Anubis*.

Osborn, D. J. and I. Helmy. 1980. *The Contemporary Land Mammals of Egypt*. Chicago: Field Museum of Natural History.

Ray, J.D. 2002. *Reflections of Osiris*. London: Profile Books.

Ray, J.D. 1976. *The Archive of Hor*. London: Egypt Exploration Society.

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Rothschild, B. M., Rothschild, C. and Woods, R. J. (2001) Inflammatory arthritis in canids: spondyloarthropathy. *Journal of Zoo and Wildlife Medicine* 32: 58–64.

Ruscillo, D. 2006. 'The Table Test: a simple technique for sexing canid humeri', in *Recent Advances in Ageing and Sexing Animal Bones*, D. Ruscillo, ed. Oxford: Oxbow, 62-67.

Schmid, E. 1972. *Atlas of Animal Bones*. London: Elsevier.

Silver, I. A. 1963. The Ageing of Domestic Animals. In D. Brothwell and E. S. Higgs (eds), *Science in Archaeology*. London: Thames and Hudson, 282-302.

Smith, H.S. 1974. *A Visit to Ancient Egypt*. Warminster: Aris and Phillips.

Smith, H.S., Davies, S. and Frazer, K.J. 2006. *The Sacred Animal Necropolis at North Saqqara: The Main Temple Complex: The Archaeological Report*. London: Egypt Exploration Society.

Zivie, A. and Lichtenberg, R. 2005. The cats of the goddess Bastet. In Ikram, S. (ed.), *Divine Creatures*. Cairo: American University in Cairo Press, 106-119.